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Evaluation of Agents and Study of End-user needs and behaviour for E-commerce

COGITO Focus group experiment

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Abstract
The process of buying products and services on the Internet often implies a high degree of complexity and uncertainty about the conditions of information seeking, about items for sale, the purchase of wanted products and the actual navigation on a site. Some important problems concerning e-commerce in general and shopping at Internet bookstores in particular are outlined below.
In this report user requirements for specification of web-sites meeting the overall wishes of the end-users have been elicited. The needs are mainly based on experiments and discussions related to purchase of books, as this domain has been selected as the application domain for the e-commerce in COGITO, but the requirements are mostly common covering e-commerce in general.
Various methods have been utilised to cover the requirement extraction from as many various perspectives as possible. This includes starting with studying literature concerning the general behaviour in 'the science of shopping', going via questionnaire investigations and walkthroughs of existing e-commerce web-sites to focus group discussions, unveiling as well present feelings about existing web-sites as future wishes for the optimal web-sites to come.
One of the main features to consider, analyse and specify in COGITO was the use of 'intelligent personalised agents'. Therefore, a focus group experiment was set up to investigate and specify needs especially for this aspect. The focus group experiment was extended as compared to normal focus group discussions by having both individual 'interview by doing' sessions and group discussions. Based on a thorough analysis of the outcome of these sessions a list of end-user requirements was assembled and presented in a hierarchical structure presenting the strategic requirements as well as the procedures and operations supporting these requirements. Furthermore, in this experiment the associations of the members of the focus group concerning various types of agents were tried out in order to point to some main conclusions related to the choice of agent type.
Furthermore, as a specific and very important aspect an overview of search strategies has been presented and related to a general cognitive systems engineering method for information seeking and retrieval in a variety of domains.
The COGITO project is partially funded by CEC and the Danish Research Foundation.

Contents

1 Introduction

Focus group interview is a very applied qualitative method that focuses on and exploits the individual participants' different expertise within a certain domain. A group consisting of 8-12 persons is assembled in order to discuss a range of topics that are specified in advance. The participants are chosen so that they match the target group of interest for instance by possessing certain skills, knowledge or behaviour. The informal discussion is facilitated and guided by a moderator that tries to keep the conversation on track and makes sure that all aspects of the topics are covered (Nielsen, 1993).

The focus group interview allow participants and researchers to become deeply absorbed in a subject and provides an opportunity for a rational as well as emotional consideration of the discussed theme. Using focus groups interviews makes it possible to collect information and user requirements from several persons at a time and the interaction going on between these people in form of exchanges of views and debates during the session provides more varied and detailed information than could have been obtained by interviewing the same persons individually (Mehlbye, Rieper & Togeby, 1993). The individual participants expressions serve as an input to the other participants thereby creating an effect of synergy in which different attitudes are probed and interpreted within a kind of collective hermeneutic. By means of the focus group interview requirements or certain angles on topics, which participants might have thought about but haven't been able to express a need for before, are generated and made explicit (www.mindresearch.dk/forside.html). The mechanisms of group dynamic can then make the group discuss subjects that weren't obvious to the individual.

2 Attention of the focus group experiment

The objectives of WP7 are focused 1) on the notice and accept of the Visual Persona and whether the human-computer interaction is improved by an expressive visualisation of the virtual agent, 2) on getting the user into a dialogue where they reveal enough information about the contents as well as the context of their searches to provide the tailoring techniques with data sufficiently rich to make probable inferences, and 3) on tailoring the dialogue towards the individual user, which point to the need of personal information of the end-user. The last task put heavy efforts on building up trust and confidence between the use and the agent to convince the user about the future advantage in revealing such information.

Therefore, the user requirements related to the virtual (or intelligent) agent are of extreme importance for building up this trust and for supporting the natural and prosperous conversation between the user and the agent giving the payoff in form of more useful purchase suggestions and increased purchase.

Furthermore, the 'Heuristic Evaluation and User Walkthrough' of the existing BOL site performed by University of Bari (see appendix 3.3) as well as the 'Requirements Analysis' by BOL (see appendix 3.5) cover to a high degree the user requirements related to general and hedonic quality based on the existing BOL. Therefore, we have focused more on the requirements related to the use of intelligent agent(s) taking over the communication and interaction with the customers.

Intelligent agent may be defined as follows:

Programs, used extensively on the Web, that perform tasks such as retrieving and delivering information and automating repetitive tasks. Agents are designed to make computing easier. Currently they are used as Web browsers, news retrieval mechanisms,

and shopping assistants. By specifying certain parameters, agents will "search" the Internet and return the results directly back to your PC.
http://webopedia.internet.com/TERM/i/intelligent_agent.html *(cited 11 Jan. 2001)*
In the following an analysis of intelligent agents and mediator roles based on literature studies is presented. The analysis provides some interesting cues to the development of the functionality of intelligent agents. This section is followed by the results from empirical investigations of users' needs for intelligent agents.

3 Intelligent agents and mediator roles

The aim of the COGITO project is to specify in general the appearance and functionality of intelligent agents supporting users in navigation and decision making on Internet sites, and to try out the results by developing and evaluating an intelligent agent for the large Internet bookstore BOL. The purpose of the intelligent agent is to help the user of the site – the buyers of the bookstore's products and services – navigate the site in an effective and user-friendly way thereby trying make the users stay longer time at the site and consequently increase the possibilities of the users actually buying something. The agent will be able to help the user search for and retrieve different products, browse in special offers, order books or other items, specify the payment, and provide contextual help in any given situation. In searching for and retrieving information on the site the context of the search will be constrained by among other things the user's information need as stated in the dialogue with the agent and the classification scheme applied in the system for organising the books. In spite of this the agent is left with several opportunities to mediate the search and thereby guide the users. This guidance can help the users identify and modify their information need and make clear the conditions of the searching, ordering and purchasing phases.
According to Pejtersen (1981) the mediator needs a performance criterion that can guide the search process and within that, the selections made between countless relevant documents. One of the criteria could be cultural mediation, that is the mediation of quality literature and value criteria with the purpose of enlightening the users. The need of a performance criterion applies to the intelligent agent as well as to the mediator and some kind of value-based mediation is relevant to the intelligent agent, since it can contribute to the users utilising the website in a more effective way and moreover increase user satisfaction, thereby making the users feel comfortable navigating and buying products. The mediation of values is of great importance to the Bookstore because it gives the organisation an opportunity to influence the users' choices and behaviour on the web. An example of this could be guiding user to a specific product in order to increase the sales of the product in question or eliciting information about user demands. Of course the actual degree to which certain values can be imposed on the users will be a matter of company regulations that determine the range of the intelligent agent's interaction with the user and definitely also the extend to which the individual users accept the attempts to exhort an influence on them.
In the following different mediator roles are examined and parallels are made to the mediating functions of a future intelligent agent of the Internet bookstore.
For centuries librarians have mediated the search of users in both public and research libraries. The roles, which the librarians have taken up have changed and evolved through time; from acting as neutral guides to playing an active part in defining information needs and providing documents of high quality in co-operation with the users. Here four typical mediation processes are described:

1. Passive neutral mediation.
The identification of the user's needs takes place according to the user's literary values. The purpose of search is to achieve the best match between the potentials of the system and the mediator's own model of the user's concept of values. The search can be performed strictly within the frames set up by the initial user request or a negotiation between mediator and user can take place as to define the frames of the request. The user's view is the basis for the search for which reason the mediator is neutral and leaves choices to the user.

2. Active neutral mediation.
The mediator elicits information about the user's need but he tries to add alternative value criteria. The performance criterion that guides the search is a combination of the user's literary values and some generally accepted sets of literary values. The mediator is oriented against these values and he makes choices on behalf of the user on premises originating partly from the user and partly from institutionalised values.

3. Selective objective mediation.
The mediator aims at a development of the user's need in accordance with his own personal, subjective convictions about literary values. He wants to exert influence on the user's reading experience and concepts of value. He mediates with the objective of getting a match between the user's and his own criteria, which are based on commonly accepted values as in 2. The user's criterion of value is implicitly or explicitly known, but is ignored or only partially used in the search. The mediator chooses on behalf of the user on the basis of personal premises. The used values are not made explicit to the user.

4. Selective subjective mediation.
The mediator communicates personal ideas of a subjective character derived from personal experience. The performance criterion is to exert a personal influence on the user or establish a personal channel of communication. The user's values are ignored in the search and the mediator chooses on behalf of the user on the basis of private premises (Pejtersen, 1981).
If the intelligent agent embarks on the passive neutral mediation he will accept the statement of the user's need and try to match his own perception of the need with the potentials of the system. The perception of the need can be based on knowledge about this specific user, on general user profiles or on search heuristics stored in the system. The agent can choose to negotiate the meaning of the information need to some degree but he remains a neutral intermediary. The negotiation can take place as a listing of the possibilities of the system e.g. the different possible search strategies or the various checkout procedures. Based on the choices of the user, the agent can make inferences as to the specificity of the need and the values in relation to this and thereby guide the search. The most important function of the agent in the passive, neutral mediation process is to list options and let the user choose from these. The agent can profitably take up this position when the user states his need and purpose of visiting the site very clearly and thereby lead the user swiftly and effectively through the site to a purchase of the wanted books or other products.
When the intelligent agent takes up active neutral mediation he examines the information need of the user but adds generally accepted literary values. This indicates a promotion of certain quality aspects of literature but could also be recommendations according to current trends e.g. a focus on quality biographical reading. The agent will then make choices

during the search on behalf of the user based on the user's values and the generally accepted literary values. Again knowledge of the user need, can be derived from the actual interaction or from former interactions with the particular users or other users. The generally accepted values stem from literary history, literary schools and directions or literature critics. The agent can prioritise specific search strategies and present these to the user. Particularly a browsing strategy displaying high quality books first can serve this purpose of mediation. Guiding the user through or letting him see selected lists of top ten rated books, recommendations or literary reviews, while navigating the site, are other alternatives. The agent can take up this position when the user doesn't formulate his need in specific terms, has a muddled information need or shows an interest in exploring the system for example by trying out different features on the site. It is up to the bookstore whether or not there is a wish to promote these literary values, which probably not yield a direct, visible economical return. It could though provide the company with an image of a company that takes quality enlightenment seriously and in that way serve as a competitive parameter contributing to outdistance the competitors. Thus on a long-term basis the use of literary values could turn out to be a lucrative business.

Using the selective, objective mediation the agent is trying to develop the user's need with a strong emphasis on his own, subjective literary values, which are based on commonly accepted values. He will try to influence the user's values and often leave out the user's personal criteria in the search. The agent also makes the choices during the search according to his own convictions about values and relevance. By using this mediation process the intelligent agent is to a large extent in control of the search process and he represents the bookstore's convictions about literature. The agents is able to pick out the generally accepted literary values that matches the overall goals of the company e.g. the marketing and selling of books. This focus could give a skewed distribution of books available to the user, omitting literature with a small clientele. Furthermore the company is able to define more narrowly the recommendations and reviews they want to display on the site as opposed to the more neutral guidance in the mediation processes mentioned above. This means that the company can put an emphasis on best sellers and select literary values that best suit company purposes. As in the passive neutral mediation process the intelligent agent can guide the user's navigation on the site but in this case limit the action possibilities of the user by choosing certain displays or routes through the site. Promoting company convictions about certain classes of literature, authors or subjects can be done by displaying selected best seller lists, interviews with authors and recommendations.

Finally by choosing to take up a selective subjective mediation the intelligent agent communicates ideas solely based on the concepts or experiences of the bookstore company. This means that the mediation is based on very subjective values and that the purpose of the intelligent agent is to make a strong influence on the experiences and behaviour of the users prompting them to buy the products of the company. Also the agent exclusively chooses between alternatives on behalf of the users. Thus in this mediation process there is a very strong element of manipulation since the user is not an active partner in the search and the premises on which products are selected seldom are made clear to the user. This can result in an interaction that is not transparent to the user and therefore causes misunderstandings and anxiety. To avoid this values and objectives of the company could be made explicit somewhere on the site allowing the users to reflect on the interaction and evaluate the results of searching the system in the light of the company values. Using the two selective mediation processes where the user's needs or choices are controlled or partly ignored by the intelligent agent there is a danger of taking away the initiative of the user. This could imply that the users feel alienated from the system thereby quickly loosing interest in the interaction and leaving the site without buying. Because of

that it will be of outmost importance to maintain the user's sense of being in charge for example by providing opportunities for the selection or discarding of strategies, displays etc. The strong subjective mediation allows the intelligent agent to control the direct communication with the user and thereby establish a personalised dialogue with the user. This can help elicit information about the user and thereby contribute to the creation of a profound knowledge about user needs and preferences and at the same time help the user feel at ease or even amused with the process. In this way the selective subjective mediation can improve the interaction with the system. This mediation process provides the intelligent agent with rather unlimited possibilities to promote certain search strategies, specific products, and features in the system. This makes room for innovative initiatives like user competitions, improved book descriptions, alternative forms of interaction etc.
The analysis of the mediation processes shows that there exists a continuum ranging from mediation guided by the mediator's or the intelligent agent's complete neutrality to mediation led by his private convictions. The communication of the implicit or explicit values is relevant if there is a discrepancy between the values of the user, of mediators and institutionally accepted values. The opportunity to mediate depends upon the mediator's or the agent's identification of the freedom he has to influence the user's choice. This depends on how specifically the user has been able to identify and express his information need and to which degree the mediator or agent has explored this need to identify freedom to mediate (Pejtersen, 1981). The more vaguely the information need is formulated the greater are the possibilities of influencing the search. The user's choice of different search strategies will also influence the mediation process chosen by the intelligent agent because the strategies leaves the agent with diverging degrees of freedom to mediate. A browsing strategy for instance gives the agent a large space for exploring and guiding the user whereas the analytical search strategy limits these possibilities. Consequently there could be strong relations between the character of the user's information need, the choice of search strategy and the specific mediation process selected by the agent. The intelligent agent can benefit from not only taking up one of the analysed mediator roles but instead encompass them all and be able to shift between them, choosing the one most suitable dependent upon the specific context or the user's explicit requirement.

4 Method utilised in COGITO

During the questionnaire survey of people's book buying styles (see appendix 3.2) we addressed a group of people with experience in buying books from traditional (i.e. non-online) sources. Therefore, their experience in buying via the net was not important. In the focus group experiment the group was based on people with high experience in using the net and with the experience of buying various kinds of products via the net. However, due to the fact that use of intelligent agents is not yet a widespread technique, the knowledge of intelligent agents was not put as a claim to the participants of the group. Therefore, partly to secure their acquaintance with intelligent agents and partly to have their direct and impulsive experience with such agents, we performed the focus group experiment in two parts, one in which we had the participants as individuals using various sites including or not including intelligent agents, and one in which they all together took part in a common group discussion from which user requirements were elicited.

4.1 Individual performance

The first part of the experiment was an 'interviewing by doing' session, in which the participants were asked to perform a series of tasks on specific pre-selected sites. About

half the sites had no intelligent agent, whereas the other half made use of an intelligent agent as an alternative to menu or icon-selecting procedures.
The subjects were advised to make use of the intelligent agent when available, partly to be acquainted with intelligent agents in general, which was important for the common focus group discussion following the individual sessions, and partly to be able to compare the use of agents with similar task solutions without having an agent available. During the session the subjects were asked to think aloud and furthermore interviewed by a moderator about their way of acting and their reactions to the agents. The complete sessions were logged on videotapes, and furthermore the sessions were surveyed by two observers taking notes. The observers were placed in an adjacent room where they could follow the sessions on two screens presenting an overview of the session as shown on figure 1 and the exact screen presented to the respondent including the actions performed by the respondent as seen on figure 2, respectively. Each session took about one to two hours.

Figure 1: Individual 'interviewing by doing' session

Figure 2: Observers for the individual session

Figure 3: Structuring of user requirements discussion

Figure 4: Focus group

A selection of video tapes were transcribed and user requirements related to e-commerce problems in general and to intelligent agents in particular were elicited. These requirements were categorised – as shown in figure 3 - in terms of means-end relations presented in general by the left hand column in figure 5 and related to book purchase in the middle column. In this representation each level will be specified by the next upper level concerning the reason or background for an action, and the next lower level will specify how this action may be supported (see figure 6). In figure 5 is furthermore shown a

condensed form of the means-end hierarchy utilised in COGITO indicated as strategic goals, procedures supporting these goals and – at the lowest level – the operations from which these procedures are created.

Means-End relations	User interest	User requirements
Goals and Purposes, Constraints	Readers' ultimate goal: Education, Emotions, Profit, Power, Social career	Strategical requirements
Priority Measures: Flow of Information, Values, People and Money	Value Criteria Related to Reading Process and/or Product Knowledge, Data, Aesthetical, Psychological, Political experiences	
General Functions and Activities	General Topical Interest in Historical, Social, Geographical, Cultural Settings and Environments	Procedural requirements
Physical Processes in Work and Equipment	Topical Interest in Specific Kinds of Plots, Subject matter, facts, events	
Appearance, Location, and Configuration of Material Objects	Reading ability and Physical Characteristics of books (size, colour, pictures) and users (sight, age, sex)	Operational requirements

Figure 5: Means-end relations in general, for user interests, and in squeezed form utilised in COGITO

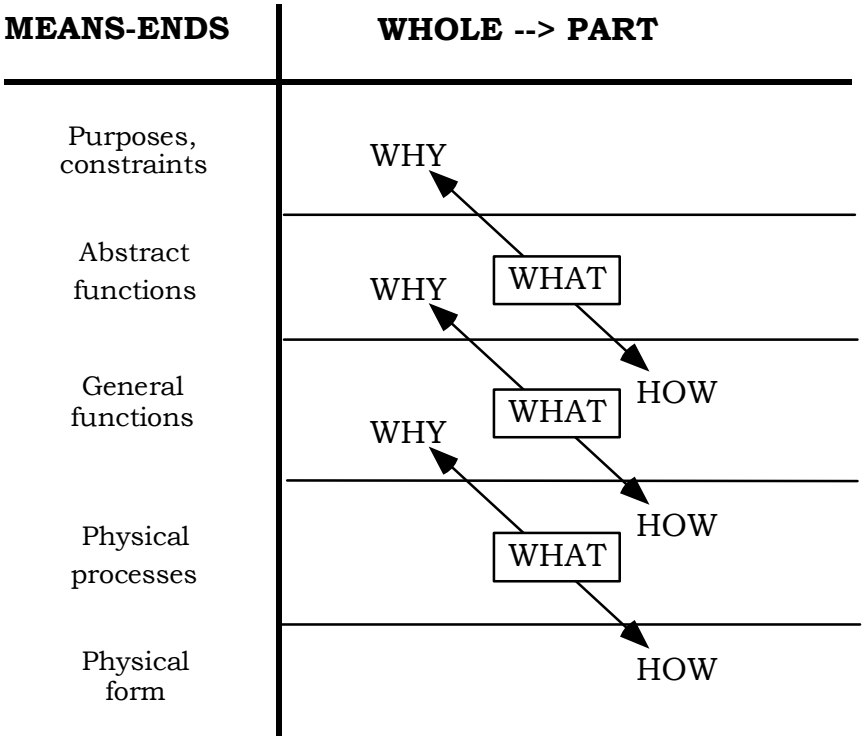


Figure 6: Relations between various levels in the means-end hierarchy

4.2 Focus group discussions

Following the individual sessions the same group of people took part in a group discussion, discussing – with the experiences from the individual sessions in mind – once more user requirements for e-commerce in general and for intelligent agents in particular (see figure 4). This time the discussion or interviews were based on scenarios, in which the demands and wishes of the group of participants related to e-commerce purchase were expressed. One of the interviewers acted as the moderator, another observed the session and took notes, and a third person structured the output of the session on a large whiteboard. The participants discussed needs for intelligent agents, satisfactory or unsatisfactory functions of existing agents and future possibilities or potentials for developing effective agents that could be used within the e-commerce domain. All the participants contributed to the discussion and nobody took up a dominant position that suppressed and prevented others from expressing their opinion.

Once again the complete session, which lasted for about 3½ hours, was logged on videotape and transcribed afterwards for eliciting additional requirements.

An extra feature during this session was a word association test, in which the participants were presented to a number of various agents taken from the net (see figure 7). This was to unveil their spontaneous reaction to the agent in order to find the best appearance of an agent related to instilling a feeling of trust and confidence for discussing and exchanging information. Each agent was presented for 90 seconds and the participants were asked to give in writing the first words that came into their mind covering all kinds of aspects, like comments on appearance, indicate descriptive impressions or aspects, emotional feelings, etc. No list of words to choose among were given, so the participants were completely free to express their feelings. Based on these utterances each agent was evaluated as shown in figure 7 for each individual agent. The upper rings show common words selected by the participants, and the lower circles show a value structure of the words indicated as negative (violet (light grey)), neutral (brown (dark grey)), and positive (yellow (white)).

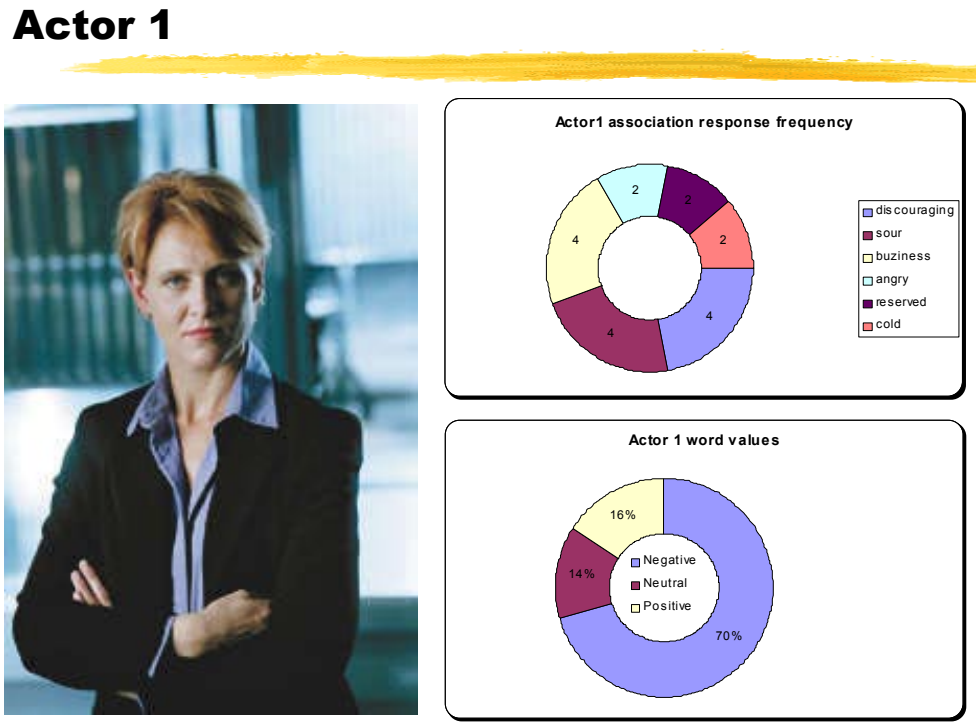


Figure 7a: Presentation and evaluation of a variety of intelligent agents

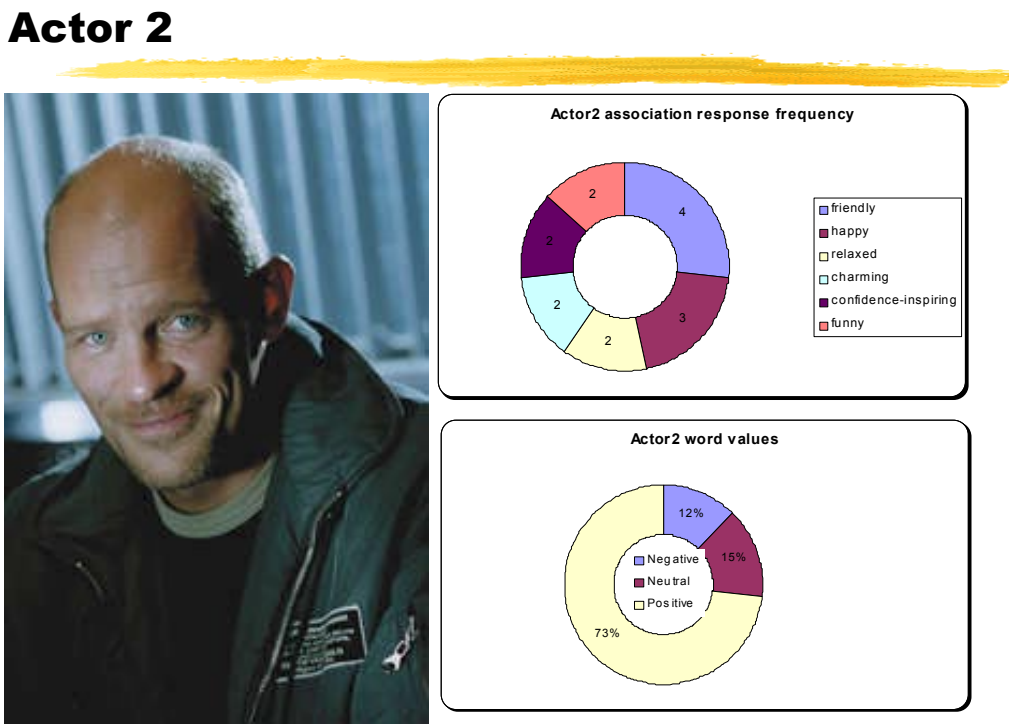


Figure 7b: Presentation and evaluation of a variety of intelligent agents

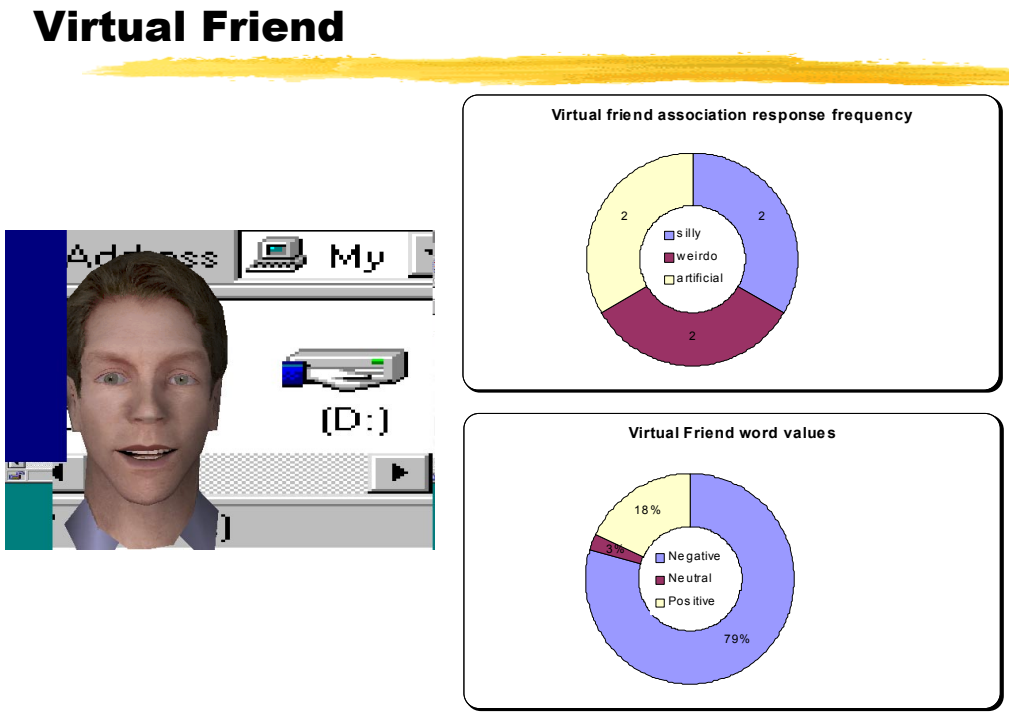


Figure 7c: Presentation and evaluation of a variety of intelligent agents

Nicole

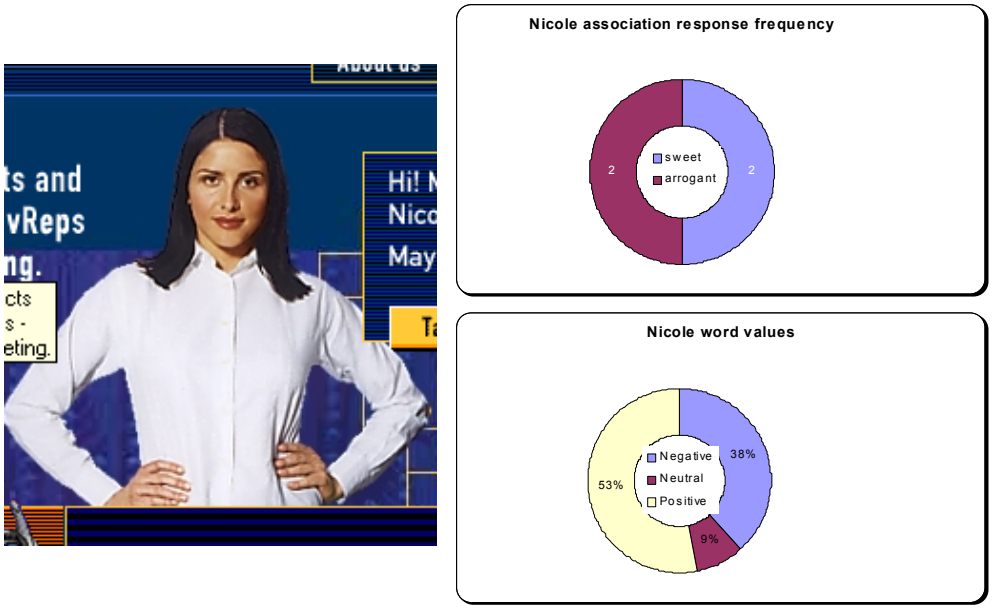


Figure 7d: Presentation and evaluation of a variety of intelligent agents

Lego

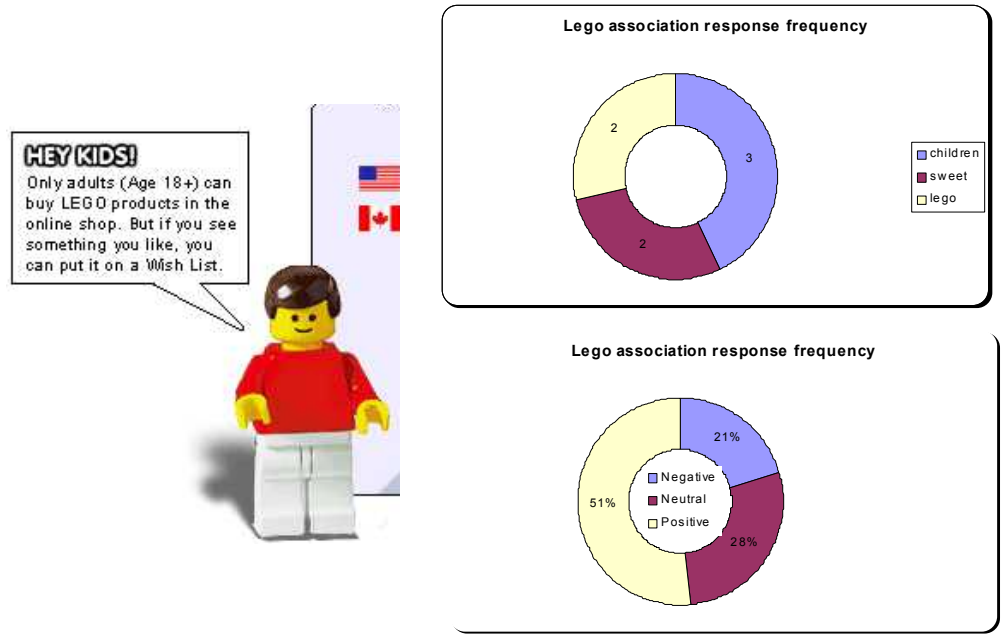
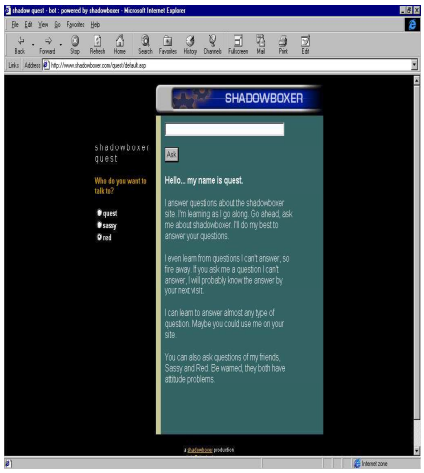
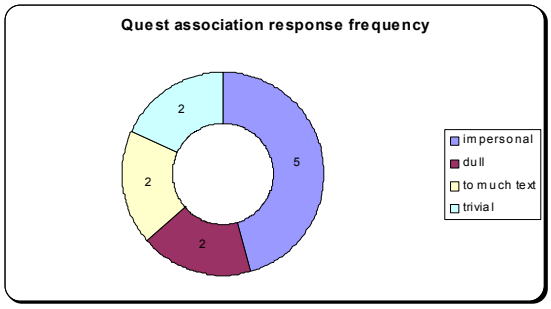


Figure 7e: Presentation and evaluation of a variety of intelligent agents

Quest





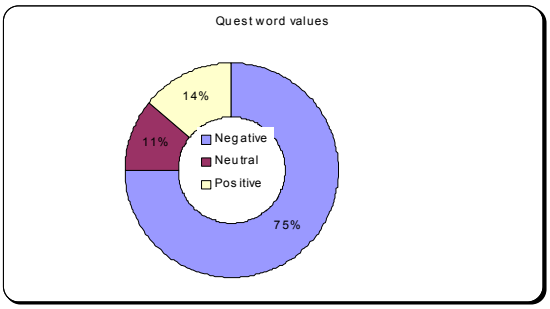
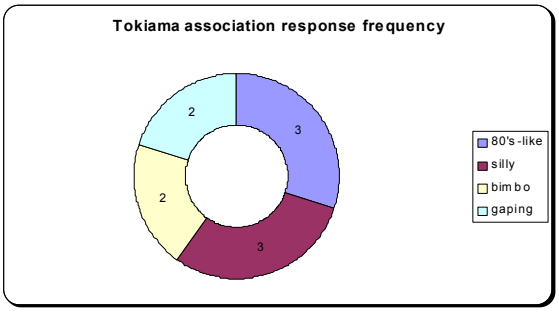


Figure 7f: Presentation and evaluation of a variety of intelligent agents

Tokiama



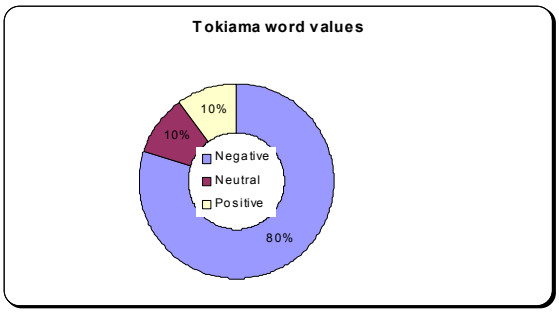


Figure 7g: Presentation and evaluation of a variety of intelligent agents

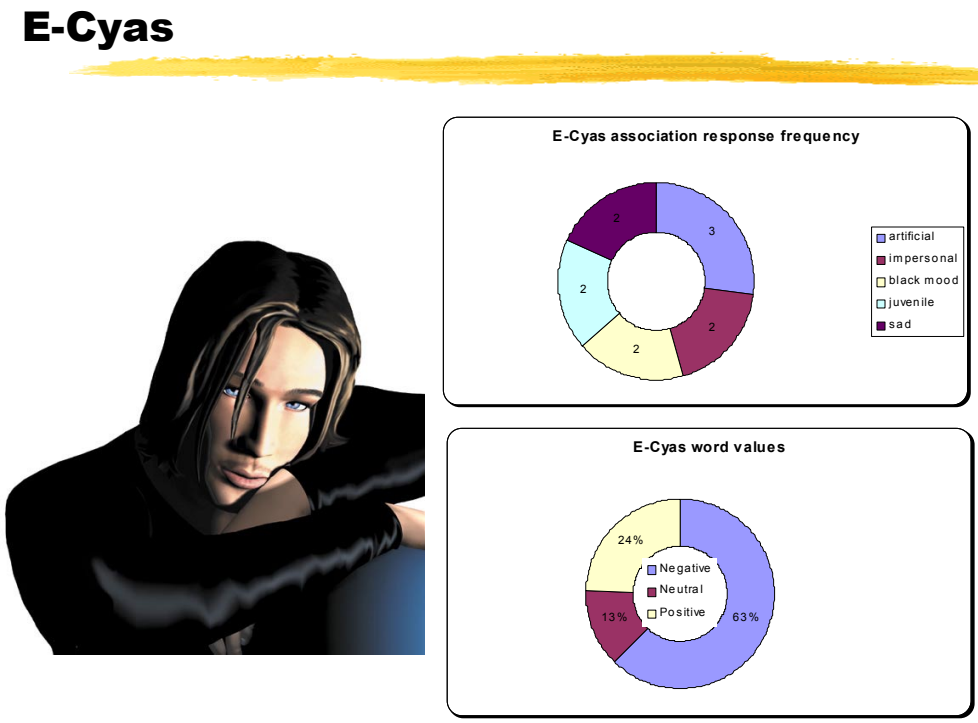


Figure 7h: Presentation and evaluation of a variety of intelligent agents

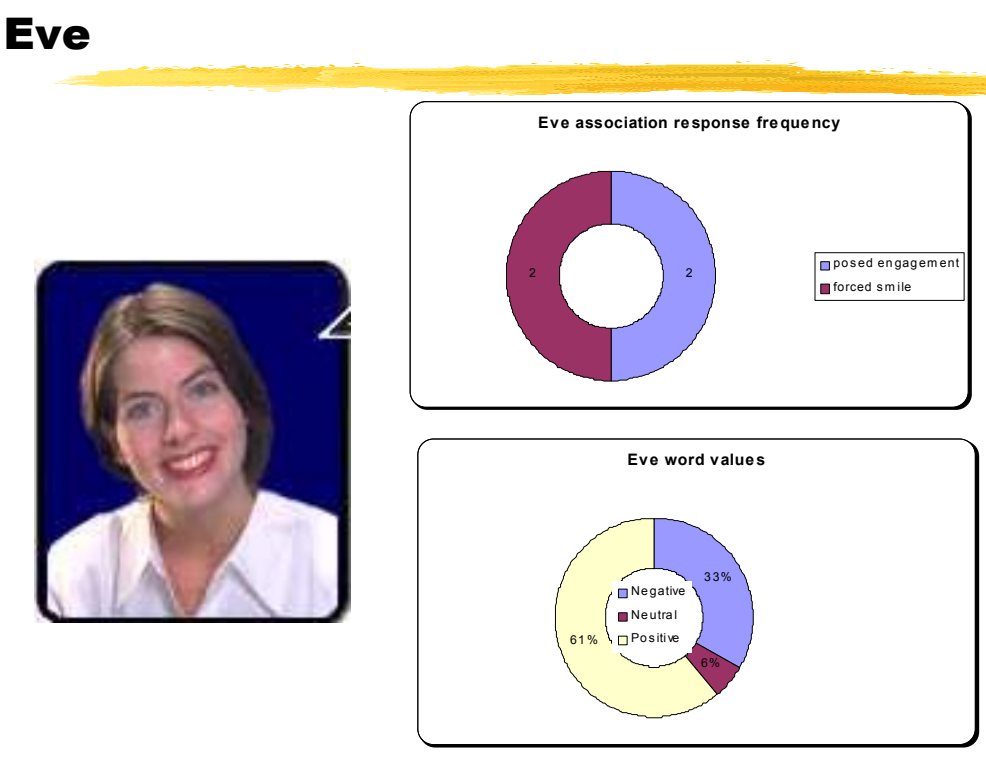


Figure 7i: Presentation and evaluation of a variety of intelligent agents

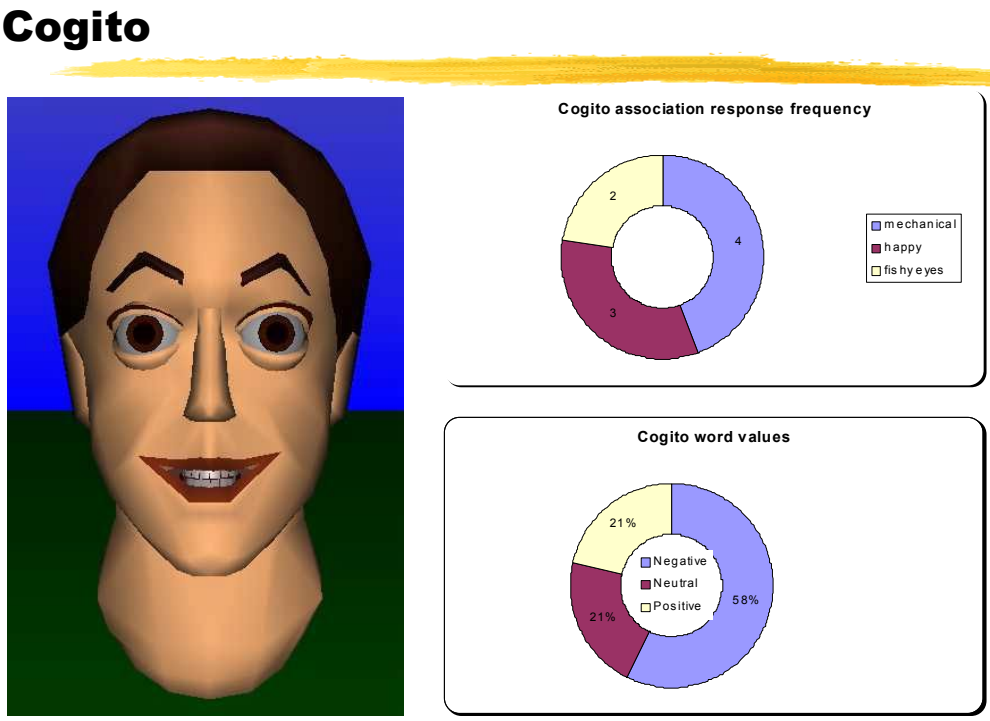


Figure 7j: Presentation and evaluation of a variety of intelligent agents

5 Results

5.1 Problems concerning the use of intelligent agents on e-commerce web-sites.

When using the agent the respondents of the Risø investigation encountered several problems. Some problems were so serious that they inhibited the respondents from using the agent effectively and some just lead to a mild frustration. Consequently both types of problems made the respondents feel they wouldn't have used the agent if they were allowed to choose for themselves and not being part of a test.

One of the major problems that all respondents were faced with was that they stated their needs or questions in a single word instead of sentences. The respondents were all used to seek information by the means of search engines using only single words and they automatically transferred their knowledge and habits from that kind of information retrieval to the communication with the agent. Existing agents, however, need several words or context in order to be able to decipher and retrieve information about exactly the item that the user wants. Not given more than one word the agent either comes up with results that makes no sense to the need of the user or he refrains from acting at all. By providing results that are irrelevant agents become useless. In the experiment carried out by Risø the respondents, when faced with incorrect answers, tried to find the wanted information from alternative sources e.g. the menus or by clicking on icons, thereby making the agent superfluous. In occasions where the agent didn't react at all the respondents got confused. They tried to reapply their word a couple of times and when still nothing happened they stopped having faith in that the agent could solve their problem and got irritated. Some respondents eventually found out how to phrase the questions by browsing in the menus and others were guided by the experimenters, but even when the

respondents phrased whole sentences, problems could arise. The agent sometimes still didn't react and gave no hints to whether it was because of a malfunction in the system or inaccurate formulations of the sentence. This again caused frustration on behalf of the users. Some of the difficulties that the respondents experienced communicating with the agent could be caused by trouble phrasing sentences in a foreign language. In relation to this respondents sometimes seemed to be searching for the right English words to submit but they didn't mention any difficulties explicitly.
The attempt of one of the tested agents to make small talk, ask non-related questions etc. during the goal-oriented dialogue with the respondent caused problems. This was due to the attention that the agent demanded of the user and thereby the constant interruption of the user's chain of thought. In that way the user was forced to reconsider his query formulation over and over again thereby increasing the cognitive strain on the user and diminishing the usability of the overall system. The respondents also sometimes perceived the interruptions as signals, which indicated that they had done something wrong during the interaction. This sometimes resulted in the respondents giving up on the agent.
Another type of problem concerned the appearance of the agent. All of the respondents felt that the agent's appearance was very important since it expressed the seriousness and quality of the agent and the web-site and by that also the trustworthiness of the agent and the information he provided and finally trust in the correct handling of customer data. However, the respondents didn't agree on what kind of visual representation they would like an agent to have. Even though most respondents preferred photos of real human beings, others liked drawn characters and still others preferred animations. This means that appearance is a very significant parameter but that there will be no single method of representing a trustworthy and seriously looking agent.
User frustration also arose due the constant need for loading of plug inns for one of the agents every time a respondent returned to the agent after having navigated the entire site. The loading enabled the agent to speak or gesticulate but it slowed down or interrupted the interaction with the system since the user couldn't communicate with the agent until the loading had finished. This involuntary pause caused some irritation.
The problems found in the examined agents indicate that the status of the technique used for building the agents is simply not good enough. High quality standards for rule-based behavior, patterns of reaction, parsing of natural language and animation are needed if the agent is to make up the truly interactive personal assistant, which is the goal of the COGITO project. If the technical instruments for developing agents are not good enough, agents will not be effective and thereby not able of handling the users needs. Instead there is a high risk that they will cause frustration that makes the users prefer other means of information seeking and retrieval.

5.2 Specification of end-user requirements

In accordance with the condensed means-end presentation as indicated in figure 5 the user requirements will be presented in a hierarchical structure corresponding to the three levels: strategic, procedural, and operational requirements. Furthermore, these levels will be related as shown in figure 6, and the strategic requirements will be described in more detail emphasising how they will be supported by the procedural and operational requirements, respectively. At the end of the section the requirements will be shown as a summary in a bullet representation in which the appearance of requirements reflects the priority.

5.2.1 Strategic requirements

5.2.1.1 Trustworthiness

The most important requirement for a customer/supplier relation - be it via a web-site or in any other form - is trust. Trust that information given by the customer will be treated in a confidential and decent way and not be misused in any way, trust about fulfilment of agreements and about the quality of purchased products, and trust concerning treatment of information related to credit cards and accounts.

Internet stores frequently offer several opportunities to the users to get tailored recommendations for books and other items, to create personal lists and to obtain news from the shops. In order to acquire these offers users must submit information about their personal preferences, email addresses, and in the case of buying items, a credit card number is imperative. Two problems arise from the need for submission of information. One concerns the creation of a user profile and another the handling and utilisation of the given information. Concerning the handling of information users often state a need for information about which of their data are saved and for what purpose. They fear that information could be sold to other organisations and that they then would receive a massive amount of junk mail from both the specific store and other unknown companies. Users are generally cautious about submitting their email addresses and feel an even greater uncertainty about submitting their credit card number. This uncertainty is enhanced if it is not made clear who the owner of the site is or if detailed information about the product is not available. Trust in that a specific e-commerce site/organisation handles the user information properly and respects the privacy of the individual buyers is therefore paramount to the utilisation of the given offers.

It is especially important when collecting information for the user profile clearly to indicate the intentions for the query and not to ask for information, which to the customer seems unimportant for the purpose, e.g. married state, number of children or income. Furthermore, customers should not be rejected if they decline to expose the requested information, but be given – based on the information available – the best possible general profile instead of the specific personal one.

Other important issues for increasing trust is to specify clearly the rights of the customer concerning delivery of goods, rights concerning possible return, payment and information of account. If possible, a quality indication in form of guarantee from an authorised institution, like a bank, would be most helpful for obtaining trust in the supplier and for delivering banking information or credit card number.

Likewise, each purchase transaction should be followed by a detailed specification summing up the order including time of delivery and the agreed way of payment.

For the customer/agent relation is it extremely important that the customer feels he/she is in charge with the agent following the wishes of the customer regarding wanted information or support in navigation. The agent should not be the leading part unless the customer specifically has requested guidance.

Finally, a clearly indicated possibility of contact to a human person or a guaranteed answer to an e-mail within a specified limited time as well as the general corporate image of the company are of utmost importance.

5.2.1.2 Mediation quality

A very important point related to mediation is the confidence the customer feels in the agent. This confidence reflects as well the direct appearance of the agent, how the agent conforms to the context in which he/she is placed, as the functionality of the agent concerning a natural conversation and the professional knowledge. If the customer lacks

confidence in the agent he/she may not make use at all of the agent, but try to navigate on his/her own using available menus or by clicking on icons missing the additional support the agent is meant to offer. Preferences concerning the appearance of the agent are presented below in the section 'evaluation of agent type'. The age and sex of the agent were discussed by the participants of the group, but this does not seem to be of great importance; however, it was mentioned that more agents, among which the customer could choose him/herself, could be available. More important was the size and location of the agent. It should not take up space showing valuable information, so it would be advisable to offer an agent that could be resized and moved around on the screen by the customer, alternatively be closed down completely. A technical issue addressed by the participants was that when the site is opened the agent should be downloaded and stored locally avoiding additional downloads each time the agent is called.
A good introduction to a site with an agent could be to let the agent appear automatically – with the potential of closing down the agent for more experienced customers - giving an introduction to the site and the agent itself, explaining its abilities for conversation and mediation. The agent should provide more levels of support to the customer, explain these levels, and leave it open to the customer to select the appropriate level to be redefined at any time. For less experienced customers – low level of the agent – the agent could join the session on own initiative if this seems appropriate due to low level of activity of the customer, indicating that support is needed. For more experienced customers – selecting a higher level of the agent – the agent should not intervene unless explicitly asked for by the customer.
The agent must be kind and polite and - besides assisting the customer in general - try to achieve information about the customer to build up a customer profile. This may partly be based on the actions of the customer and partly on personal questions to the customer without being persistent, if the customer don't want to respond to these types of questions. From each interaction the customer profile may be improved and thereby the support to the customer may be more and more personalised. This may consequently add to the inspiration of the customer and ease his positive feelings of the purchase.
Experience from the individual sessions showed that it was difficult or new to the participants to communicate with the agents using full sentences. Most of them made use of single keywords as known from search engines, and most of the agents did not react reasonably to this way of communication. Therefore, it was stated as a wish that the agent should accept full sentences as in a conversion as well as keywords normally used for a search engine. Furthermore, a dialogue history should be available allowing going back to refresh ones memory about previous phases of the communication.
Based on the individual profile compared to a group of similar profiles the agent should be able to give constructive and innovative feed-back to the customer concerning items related to the products searched by the customer.
By the way, the group of participants was very goal oriented; therefore general chat with the agent had very limited interest, whereas context related chat was accepted.

5.2.1.3 Seriousness/reliability

The respondents expressed very explicitly that the agent should be serious and reliable if he should prove useful to them. The seriousness applies to both the form of the agent represented by his appearance and the contents of the agent represented by the agent's abilities and knowledge. The appearance must be serious and sober and inspire the user with confidence in that the agent can solve problems effectively and that he possesses professional skills and is not just an amusing toy feature at the web-site. The agent must provide focused, serious, correct and reliable answers to asked questions. Furthermore he

must react to the user's input in a manner that corresponds with the question. This means that he should leave out irrelevant information and answer in a stable way possibly by providing the user with a predefined set of categories to select from. The respondents also expect the agent to learn from questions that he isn't able to answer correctly and then improve his performance. These elements are all important because they contribute to a high quality of the provided information. In addition the respondents mention the quality of performed searches as being of high priority and demand fast, relevant answers and a high response rate. Finally in relation to the need for a serious agent a thorough domain expertise of the agent is claimed as being of great significance. The expertise not only implies that the agent should answer current questions effectively but it should also make it possible for him to be proactive in the elicitation of users' unrecognised or future needs. Possessing domain expertise should also make the agent able to sense whether there is need for help or alternative offers or whether he should remain passive.

5.2.1.4 Flexibility/tailorability

The respondents stressed the need for flexibility of the abilities of the agent. This means that the agent must be able to support various search strategies allowing users to seek and retrieve information in several ways. The agent should also provide conventional navigation and search alternatives for instance by providing access to menus or by assuming the function of a search machine allowing the users to search in single words or phrases, use truncation, similarity search etc. according to their preferences. The respondents wanted to be able to ask directly for help or just type in a specific word dependent on whether they were able to identify the problem or needed to explain the problematic situation. Concerning the use of menus, there must be accordance between the menus and the knowledge of the agent so that identical information can be found using both methods. The agent should lead users to the site where appropriate information is given instead of just linking to the site just as he should go directly to a specific chunk of information instead of providing superior categories with non-transparent content. The respondents state a need for a flexible support of different kinds of information needs and purchase situations. In relation to this the agent must handle goal-oriented behaviour such as verification of titles or other specific needs and give guidance to a speedy check out. Moreover he must deal with muddled needs requiring exploration by browsing and adjust the proposing of related offers to whether the user is in a hurry or wants to spend time at the site.

Another aspect of flexibility lies within the tailorability of the agent. The respondents uttered that tailorability of both functionality and appearance was preferable. They want it to be easy to learn how the agent functions and not be forced to learn all functionality at once. In accordance with this the agent should give an introduction showing his abilities and knowledge to first time users and enabling other users to skip the intro and proceed directly to the information-seeking phase. The agent must at all times be able to explain the user's action possibilities in an understandable way. The agent must facilitate and handle the constant evolution of the user's preferences in relation to the user profile and make it easy for the user to regret and redo former choices. Finally the respondents clearly stated that they wanted a possibility of disabling the agent during an interaction and either continue on their own or ask for other kinds of assistance from the agent. Concerning tailorability of the agent's appearance the respondents mentioned a need to be able to select some sub-functions of the agent and avoid others in order to enhance the transparency and usability of the agent.

5.2.1.5 Value added services/surprise me

The respondents all expressed a wish for value added services on the web-site. Value added means services or products that provide an extra, possibly not foreseen value or experience to the user, something that surprise the user in a positive way and thereby enhance the quality of the site. One of the basic elements that the respondents need is product amendment, which consists of a large selection of products and products related to the main product. In the case of selling books related products could be pens and paper articles. Respondents also wished for a lower price level than in physical stores and a delivery service that could be matched to the current user's needs for instance by offering wrapping in plastic, delivery at user-specified hours of the day or delivery at the user's work place. The necessity of being independent of opening hours of the local post offices was stressed. Among the services that the respondents really felt would enhance the site's value were: a chat room focused at topics related to the site, wish lists with clear indication of the purpose of the lists, recommendations from experts and other users containing short presentations of the product and options for further exploration of the recommendations, reviews from papers and consumer magazines, results from customer satisfaction analyses, and graphical presentations of the products that can be tailored by the user and that can transfer the experiences provided by traditional catalogues and also a sense of actually touching the product. Furthermore the respondents would like some kind of receipt when closing the deal indicating which products have been purchased and at what prices. Finally some respondents found that context relevant commercials from the web-organisation could vitalise and touch up the site.

Another kind of value added services are incitements that the web-organisation utilises specifically with the purpose of getting users of the site to use the agent or carry through a purchase. The respondents mentioned the need for some kind of welcoming offer or discount the first time a user interacted with the agent. Some respondents felt that the agent should be able to give the user an impression of having eased his shopping experience for example by guiding the user through the site and by that serve as a reminder of things the user should do at the site. The agent could offer products related to specific user-defined events for instance a picnic thereby relieving the user's cognitive burden of remembering which things to buy for the event. This feature makes the agent proactive. The respondents expressed a need for marketing campaigns through traditional media that could make first time purchasers recognise the value of buying online assisted by the intelligent agent.

The respondents saw great potentials in user profiles providing them with value added services if they work efficiently and in a non-obtrusive manner. However they also showed mistrust in the web-organisation's correct handling of personal information required for the development of the profile, and therefore the wish of being able to build user profiles is somehow ambivalent.

5.2.1.6 Entertainment

Entertainment by the agent was discussed among the participants of the focus group and this topic seems to be a very delicate problem. On one side entertainment could be valuable for increasing the interest in the site, intensify the communication, and even increase impulsive purchase. On the other hand the risk of tiring or offending people may be very high. It was agreed that a high knowledge of the customer through the specific customer profile is very important. Traits such as culture, gender, age, education, etc. are crucial for the interpretation or misinterpretation of jokes or witticism. Furthermore, and stressing the difficulty in amusement, is the fact that the actual mood of the customer plays an important role for the perception of witticism.

Likewise, the use of jokes will be context dependent. A joke presented to a customer looking for books about cancer, e.g., may be very inappropriate; whereas a person who has previous been buying a lot of book related to, e.g., stand-up comedians, and is not looking for a new one, may very well be open to and pleased by jokes related to this specific topic.

5.2.2 Bullet presentation

- **Trustworthiness**
  - **User profile**
    - Make superior user profiles that later can be expanded/developed
    - Don't require to much input from the user since there is a low tolerance for this
    - Provide an explanation for the connection between submission of personal information and improved services
    - Don't make it obligatory to respond to delicate questions e.g. marital status and children
    - User must feel that he is in control and not the agent
    - Doesn't have to remember user's name from the last interaction unless the user clearly recognises that he benefits from this functionality
    - Make the registration of the user after having provided a good service. The agent must prove his worth before something is demanded from the user
    - Give some kind of technological gadget, free products, competitions as a reward for registration. Be aware that this might cause mistrust in the motives of the organisation and that it's important to keep the promises made
    - Provide an opportunity to communicate with a human being
    - Provide contact functions with names of the persons
    - Provide a FAQ about purchases, phone number or email of persons that can answer within e.g. 5 minutes and state when an answer can be expected
    - Provide an opportunity to deselect marketing features such as newsletters when having submitted email addresses

  - **Show intentions/avoid pumping the user**
    - Provide opportunities for selecting and deselecting saving of various kinds of user information
    - Provide information about what the information will be used for and guarantee that it isn't sold to other organisations
    - Users are normally not interested in being confronted with all information that has been collected about them
    - Explain activities in a language that the users understand
    - Write clearly all important information (the passages normally written in small letters in big letters)

  - **Safety**
    - Finish the purchase with a receipt that sums up the order and the payment
    - Provide information about delivery
    - Make the agent ask if the user wants to proceed directly to the check out zone or if he has any questions. The agent can provide a list from where categories of questions can be chosen

- Provide good possibilities of return with no extra costs for the user when e.g. quality or appearance aren't what the user expected
- Provide a link to the users' banks that states the conditions and safety of the use of credit cards
- Provide testimonials from (known) persons that have made successful purchases

- **Minimise risk**
  - Provide a lower price level than in physical stores
  - Provide a low price of delivery. Paying for delivery is ok though
  - Inform about delivery, payment, returns policy, account information
  - Minimise risk of decision making and buying by informing about products and services, providing opportunities for investigation of the product and indication of time of delivery

- **Corporate image**
  - Provide a large selection of products
  - Guarantee high quality of products
  - Make sure that no misspellings or other messiness is found at the site
  - Provide the services that have been advertised
  - Inform about the purpose of the site and about whom the intended audience is. Provide information about the organisation behind the site

- **Authority**
  - Provide quality assurance e.g. by posting a stamp of authority at the site or a button linking to a site that recommends and guarantees the value of the organisation
  - Provide reviews and recommendations from experts and other users

- **Demonstrate own knowledge by providing references to other sites only if this is demanded for the sake of broadness**

- **Mediation quality**
  - **Promote the functionality of agent and system**
    - Introduce and encourage the use of the agent

  - **Agent appearance**
    - Provide photos or drawings since they are important in order to be able to associate text with a picture. Photos give an impression of seriousness
    - Provide the agent with humanlike mimics and gestures, avoid mechanical smiles and virtual expressions.
    - Provide an agent whose sex and age can be tailored
    - Provide an agent that doesn't take up the space of more important information and doesn't dominate the screen
    - Make the agent present himself and his functionality in large size but don't let him fill out the screen and hide the context. Let the agent show his normal position and make the user aware that an agent exists

- Be aware of the features of the agent that might be relevant to an international or a specific culture
- Make the agent domain specific and related to the product on sale – context relevant
- The appearance must be associated with real-life stores and the product e.g. a cashier that registries the purchases
- Make the agent dynamic and changing if the site also changes
- Provide the agent with a good image
- Provide an agent whose functions are loaded once and for all during the session and no plug-inns are necessary
- Make him invite the user to phrase questions by e.g. making the agent obliging, co-operative, polite and by placing his head in an oblique angle
- Make the agent tailorable instead of forcing the user to select a specific agent
- The agent must not appear if he has been deselected
- The agent should not assemble the irritating shop assistant that can't leave the customer alone
- Be aware that animations are ambiguous and can yield confidence or distrust. More animation isn't necessary to make the character look and function more like an agent. Animation can make the agent fun and obliging.

- **Agent self-explanation**
  - Provide agent information and help functions
  - Provide information about coverage of the website
  - Provide information about phrasing of questions, use of signs and give examples
  - Guide the user through the site and support decision-making and memory

- **Support natural dialogue**
  - Avoid repeated requests for submission of personal information during the interaction with the agent
  - Avoid obtrusive questions from the agent to where the answers are already given, e.g. the agent asking if he should perform an action that the user has already specified
  - Avoid stressing the user by taking up an expecting position
  - Provide an opportunity to disrupt an ongoing dialogue and pose a new question or accept action possibilities before the agent has finished lining up the alternatives
  - Keep answers brief
  - Keep communication simple
  - If the agent is equipped with humour it must be fitted to the user's sense of humour (see strategic requirement: entertainment)
  - Make the agent ask questions similar to the ones posed by a librarian in the reference interview in order to elicit the need, e.g. "For what purpose do you need the item?"
  - Provide guidance on and ask the user if information is needed about: book recommendations, subjects, walk through to the check out zone, explanation of returns policy, presentation of products and possibilities for choosing e.g. price, publishing year, level, amount of hits to be presented
  - Provide flexible/innovative answers

- Don't provide the agent with any personal history

- **Provide dialogue history**

- **Constructive feedback**
  - Ask questions for elicitation of needs
  - Line up actions possibilities that show how to move on
  - Indicate that a query is being processed, that no answer can be found, that the result is ready or that further information is available
  - Make it optional to rate the agent
  - Allow the agent to recommend related titles but avoid elements that are out of context. Make it possible to proceed to further information by clicking
  - Provide a physical touch of the products in the presentation. A visualisation that makes the user "sense" the product.
  - Provide an opportunity to compare products e.g. contents and aesthetics

- **Provide only context relevant chat**
  - Provide relevant quotations and reviews

- **Provide a clear separation between the agent's area of communication and the presentation of results**

- **Make it comfortable to use the agent**
  - Make the agent support the user's memory and navigation
  - Make the agent work as a land mark or anchor that helps the user find his way back to subjects or sites that have been explored earlier
  - Make the agent work fast
  - Give the agent a large domain expertise
  - Provide an opportunity to resize and move the agent
  - Make the functions of the agent tailorable so that a user can select sub-functions according to his preferences. Make levels of agent interaction that the user can request and that are visible to the user and changeable at all times
  - Provide a sense of easing the shopping experience and inspiration by personalising the offers.
  - Personalise the offers to individual user and not target groups. Personalization must not be stereotypic and must show improvement for every new interaction

- **Seriousness/reliability**
  - **Quality of information**
    - Provide focused, goal-oriented, serious answers
    - Provide lists from where the user can select
    - Make the agent answer in a stable manner that suits the kind of question
    - Make the agent learn from the interactions and evolve accordingly

  - **Quality of search(results)**
    - Large number of responses to posed questions
    - Fast answers
    - Provide a high rate of precision in retrieved items

- **Domain expertise**
  - Make the agent proactive in his elicitation of user needs based on previous experience
  - Make the agent able to sense whether or not he is needed or should remain inactive

- **Serious agent appearance**

• Flexibility/tailorability

- **Agent/search engine**
  - Provide facilities for truncation, simple/advanced search, search for single words and phrases
  - Go directly to sub-categories of information by searching for help or typing in a single word
  - Make the agent able to recommend products that are similar to already bought items
  - The agent must perform exact match and then best match searches

- **Agent/menu**
  - Support alternative search strategies so that information can be sought in several ways. That means that alternatives to the agent are given by providing conventional ways of navigation and search
  - Make sure that the agent's knowledge and the information obtained from menus are the same
  - Make the agent able to provide the user with the appropriate site and category of information and not just a link

- **Tailor agent's functionality and appearance**
  - It must be easy to learn how to use the agent
  - It should not be necessary to learn all functionality at once
  - It should be possible to skip the agent's introduction and proceed to information seeking
  - The agent must be user-friendly and explain all action possibilities within the current context
  - The answers and explanations given by the agent must not be too heavily loaded with information
  - The agent must provide several ways of presenting the products e.g. the product by itself or listed and compared with other products
  - It must be easy to regret or redo choices. New choices should be reflected in the user profile
  - The user must be able to deselect that information about him is being saved at all periods of the interaction
  - The agent must support and handle a continuous development of user preferences, for instance by transferring more titles to favourites
  - The user must be able to deselect the agent during an interaction and decide if he wants to continue on his own or define what kind of help he might want instead

- **The agent must support various information needs and purchase situations and give suggestions that are related to these**
  - Support goal-oriented behaviour e.g. verification of titles
  - Support muddled information needs e.g. browsing
  - The agent must adjust his performance to whether the user wishes to leave the website quickly or aims at spending more time at the site

- **Value added services**
  - **User profile**

  - **Provide recommendations**
    - Provide analyses of customer satisfaction
    - Provide reviews from newspapers and consumer magazines
    - Provide recommendations that consists of a short presentation and opportunities to explore other levels of the recommendation e.g. other customers' and experts' opinions

  - **Presentation of results**
    - Provide a graphical presentation of cover, contents, pictures, layout etc.
    - Provide a presentation of the product from several physical angles
    - Provide the user with a delightful experience normally provided by physical catalogues e.g. high quality pictures and product descriptions
    - Enable the user to tailor the presentation according to his personal preferences

  - **A good finish of the deal**
    - Provide the user with a receipt indicating which products have been bought at what costs

  - **Incitements**
    - Give welcoming offers when the agent is used for the first time
    - Give the user an opportunity for rating the agent's performance
    - Market the agent through traditional media to obtain the confidence of first time purchasers. Use famous or know persons that do online shopping to create a trend
    - Give the user an impression of easing the shopping burden by supporting the memory of the user guiding him through the site thereby reminding him of things to buy
    - Make the agent proactive by providing offers in relation to a user-specified event e.g. a picnic so that the user doesn't have to think in product categories

  - **Product amendments**
    - Provide a large selection of products and related products
    - Provide a competitive price
    - Provide the user with opportunities to specify the delivery
    - Minimise the dependency on post offices and similar distributors

  - **Provide a wish list**
    - Make clear the purpose of the list

- Make it optional if the user must accept receiving information from the web-organisation
- Make clear if the user must submit personal information to create the list

- **Chat**
  - Provide a chat forum that focuses on relevant domain specific issues

- **Advertising**
  - Provide context relevant advertisements that enliven the site
  - Advertise only/mainly for the site-owner
  - Use advertisements as a quality mark letting only quality organisations advertise

- **Entertainment**
  - **A fun appearance might raise the interest in using the agent and intensify the degree of communication**
    - The entertaining features must be context relevant
    - The entertainment must be fitted to the user profile and to the actual mood of the customer
    - The agent might by entertaining the user encourage impulse buying by showing news and giving inspiration within various subject categories

5.2.3 Evaluation of agent type

The respondents in the word association test in most of the cases didn't use the same words to describe their associations related to the 10 agents. Therefore the frequency of different adjectives is high. However the applied words fell into three categories representing negative, neutral or positive attitudes or feelings towards the agents. It is quite remarkable that the humanlike agents generate the most positive associations and judgements and are perceived as being charming, confidence inspiring and friendly. The agent that got the highest percentage of positive words, figure 7b, is a real life actor, who has been heavily exposed in television series lately. This might influence the respondents' reactions and could furthermore indicate that recognition of known (sympathetic) characters plays an important part in shaping attitudes towards agents. On the other hand, another real life actor from the same series, figure 7a, also playing a sympathetic role in the series, had a rather low positive score. The agent from Lego achieves a high amount of positive words, a fact that can be attributed to his coherence to the domain he acts within. The respondents all expressed a clear need for context dependent agents because these seemed more trustworthy and knowledgeable. The agents that received the most negative response were judged to be very weird, artificial, and silly. As an interesting point we had included a site without any agent, figure 7f, due to the fact that some participants during the individual session claimed that no agent was needed, and they could just as well communicate with the 'text field'. However, presented to this situation during the word association test, this situation was evaluated as impersonal, dull, too much text, and trivial, resulting in a very high negative score. The discussion that followed up upon the word association test showed that the respondents didn't agree on the most suitable appearance of an intelligent agent and that the majority wanted an opportunity to tailor the agent according to personal preferences.

5.3 Search Strategies

5.3.1 Introduction.

In several projects within cognitive systems engineering users' unique mental search strategies have been identified and have subsequently been supported in information systems. These projects show how users utilise or prefer to search for information and navigate by the means of, among other things, flexible search strategies that allow for an exploration and modification of their information need during the interaction with the system in several different ways. The results of the studies also show that shifts between strategies frequently occur, and that these shifts give the user opportunities to explore and develop his information need and the contents of the system from different perspectives.
In a system for e-commerce in which users will search for information about products as well as for the product itself, it will be of outmost importance to support these mental strategies in order to enhance the effectiveness and usefulness of the specific site to the user. An intelligent agent can take up a valuable position supporting some or all of these strategies.

5.3.2 Cognitive system engineering within domains of information retrieval.

Cognitive system engineering is concerned with the design of information systems for support of people in their actual work situation based on a systematic analysis of their cognitive tasks and their mental strategies. Human actors are basically goal directed, adaptive organisms. In any task and work environment the variety of options with respect to 'what to do when and how' is great. In general, however, an established practice will evolve within the goals and constraints given by work, guided by the subjective preferences and work styles of the individual actors. Therefore, in order to understand why a particular piece of behaviour is chosen instead of another possible pattern and to be able to predict the response to changes, when new information systems are introduced, we have to understand how all the action alternatives in a particular situation have been eliminated such that one unique practice can manifest itself. In order to design new information systems, which cope with the end users' task requirements and problem solving activities, we need to know what kind of behaviour to expect, and therefore we have to identify the work depending constraints, which define acceptable work performance and the constraints as posed by the tools and means available for work. In addition, it is necessary to know the subjective performance criteria, which are used by the individual agents to resolve the remaining degrees of freedom (Pejtersen, 1995). The framework for cognitive work analysis is the result of a generalisation of experiences from field studies, which have led to the design of support systems for a variety of modern work domains, such as process plants, manufacturing, hospitals and libraries. The framework provides a general approach to help designers of information systems to understand the complex interaction between work domains and users' cognitive and social activities and their preferences during task performance. By the construction of a means-ends hierarchy consisting of five abstraction levels; goals and constraints, priorities, work functions, work process and physical resources, it is possible to identify the *why* and *how* attributes of any function in the system, and the *what* aspects (Pejtersen & Fidel, 1998). The analysis thereby addresses dimensions such as; the actual work environment, the work domain, task situation in terms of work domain, decision making and mental strategies that can be used, the organisation in terms of division of work and social organisation and finally user characteristics, resources and values (confidential doc.). Cognitive system engineering, including the cognitive work analysis, has been applied within several domains of information retrieval

to analyse the methods and strategies of information seeking and retrieval, information sources, and the mental strategies and subjective preferences of the actors of the domains.

5.3.3 Search strategies within different domains.

A set of five mental search strategies were originally identified in the "Book House Project", but have since been verified in several other domains since users utilise identical strategies for seeking and retrieving information about various subjects. The identified search strategies are; the analytical search strategy, the empirical search strategy, the browsing strategy, search by analogy and bibliographical strategy.
The strategies are found to be common to several different domains because of their identification in diverse projects covering various topics and domains. The projects focus on various types of data, user populations, applied methods and approaches. Five projects in which the strategies have been identified serves to illustrate this point. They are: 1. Within the library domain the "Book House Project" concerned retrieval of fiction in public libraries as well as in school libraries. Researchers designed an information system that supported the identified search strategies. 2. Within the design domain researchers of the "Design Explorer Project" investigated the retrieval of information for design of mechatronic products. 3. Within the web-domain the "Diceman Query Application Project" focused on the retrieval of video clips from large digitised archives on the Internet. Another project analysed Boeing engineers' retrieval of task-specific information from their local Intranet at a large aircraft manufacturing company and from the Internet. Finally researchers in a project about IR on the Web examined the retrieval of online information for class assignments by high school students. The projects are described in more detail below. The application of the search strategies in these domains gives a very strong indication that the strategies are applied when users utilise systems for e-commerce as well. Therefore focusing on and implementing the mental strategies are imperative to the development of a useful system that satisfies the users' needs.

5.3.4 Description of the projects.

The Book House. The Book House Project concerned the development and evaluation of an information retrieval system for fiction for use in public libraries. The users of the system were library patrons of the age 6-70 years and librarians. The Book House enables users to identify their information need, match their query to the retrieved books, evaluate the results and modify their query in accordance with the obtained relevance feedback. The Book House system represents a user-based system design approach and is based on field studies in libraries. The domain in which the system is applied can be characterised by being heterogeneous because of the various kinds of documents, their number and fast development plus the variation in the user group in relation to demographic, social, cultural and cognitive differences. The design of the system follows the principles for ecological system design implying that attempts are made to make the structure and the content of the database transparent to the users thereby causing a decrease of the users' cognitive load while searching the system. The knowledge base and the navigation of the system are based on users' needs and their preferred search strategies. This is done from an analysis of users' requests and ways of characterising document content during negotiations in the library. The results of the field studies are formalised in terms of a classification and indexing system that are used for database design, and a set of retrieval functions that correspond to the search strategies in a consistent way. The aim of the design of the Book House system was to create an organisation that reflected the users' needs and task perspective. Results from the analysis of search strategies applied by users in libraries were used to design the retrieval functionality, the search dialogue, and support of users'

navigation in the database (Rasmussen, Pejtersen & Goodstein, 1994). The Book House system also exists in a version for school libraries and covers the retrieval and indexing of both fiction and fact literature for children (Pejtersen et al., 1994).

The Design Explorer Project. The aim of the project was to analyse the general structure of a (potentially) shared information system that integrates the www and local and global databases. Field studies of engineering design projects was carried out at a large Danish manufacturer of valves and other mechatronic products in order to examine information use, including among other things the information needs of engineers, their communication, the information flow in design processes, information retrieval and information sources. Concepts and systematic techniques for this analysis were found in the framework for cognitive work analysis. One element of the framework investigates the task decisions of the involved actors. In this case the involved design participants were both novices and experts with a couple of years and up to fifteen years of experience in designing. The designers had different subjective knowledge and knowledge of company practice and standards, which was supposed to be represented in the system. In the project it was found that the engineers used several, different strategies for information retrieval from external organisations and colleagues. These strategies comprised analogy strategy, analytical, model-based strategy and browsing strategy. The strategies turned out to be identical to the strategies identified and implemented in the Book House project. Analyses showed that a predominant task strategy for information retrieval was exploration by analogy. A number of heuristics and analogical reasoning were used to identify colleagues who had had similar problems and hence possessed the desired expertise. The analytical model-based strategy was used for the analysis of a specific subject matter and empirical heuristics and short cuts were used to browse and ask colleagues for advice. The choice of strategy depended on criteria like time, intellectual effort, and the confidentiality, reliability and availability of information. In the early phase of a task browsing and exploration by analogy were predominant, while the analytical model based strategy were frequent at a later stage of work. These varied uses of the strategies made it obvious that it is necessary to adapt the information content to different strategies and provide access to databases according to different search strategies with different search algorithms (Pejtersen, 1997).

The Diceman Query Application. The project designed and developed the Diceman Query Application, which is an end-user query application for a video indexing and retrieval project based on the Diceman architecture for distributed Internet content exchange. The query application was developed to support different search strategies of users assessing large video archives that had been indexed with a complex indexing language. The developed query interface was driven by three of the five search strategies for accessing a large collection of books that Pejtersen identified in the Book House project (Rasmussen, Pejtersen & Goodstein). This application thus supports the bibliographical strategy, the analytical strategy and the similarity strategy. The explorative features of the analytical strategy supports the main form of search in the Diceman, namely a complex, iterative query development. There are also possibilities for query refinement in accordance with the development of the information need. In the similarity search users are allowed to manipulate query elements for the purpose of query modification and furthermore for varying the weights of elements to stress those elements they are interested in. This is in essence the specification of how the users define similarity for the object and search. Analytical and similarity searching are likely to be important for both known-clip and stock-clip searching. The project showed that the strategies can be combined and in

that way complement each other resulting in an optimisation of the search results by limiting the space being searched. The researchers found that the two strategies that aren't currently implemented - the empirical strategy and the browsing strategy were both relevant in relation to the search of video clips in archives, but that further research is needed in order to make clear the options for implementation (Dunlop & McDonald, 2000).

Web-searching of engineers in a large aircraft-manufacturing organisation. The goal of the study was to investigate the information seeking and searching behaviour of engineers in the large aircraft-manufacturing organisation Boeing, when searching for information on the web that is on the local Intranet and on the Internet. The objectives of the study were to create a description of major patterns of web use, to examine the effectiveness of these patterns, and to make recommendations for improved system functionality and interface. The study method was guided by a conceptual framework for work-centred evaluation and design of information systems. Data were collected from nine engineers while they performed their regular, job related searches on the web. The engineers used a range of tools to perform analysis, design, and to communicate with others. Most of their tasks required the use of new information. They used a variety of information sources, and the sources most preferred were other people and the web, then the library. During a search the engineers would plan, select information sources and identify information needs. They were sure about their information needs and rarely felt the necessity to analyse or modify the needs. Data show that the main cognitive activity during search was to make decisions about relevance, then decisions about eliminating and adding terms. The same search strategies as discovered in the Book House project were identified; browsing, analytical, empirical, similarity and known site, which is identical to the bibliographical search strategy. All the strategies were employed. The engineers most frequently selected the browsing strategy and the analytical strategy, in which they used their knowledge about the subject domain and the search system to plan the next steps. The empirical and the known site strategy were the third and four-most utilised strategies followed by the similarity strategy (Confidential document)

IR on the Web.
The study explored human searching behaviour on the World Wide Web by examining the searching behaviour of a group of high school students. The students searched the Web in order to retrieve information they needed for class assignments. Field studies were carried out at a high school in Seattle, Washington. The information processes of the students' task decisions included analyses of the task situation and information need including: idea generation, planning a search, evaluating alternatives among different search approaches and options and comparing the match of retrieved documents with information needs. In the study the same search strategies as described above were identified. The student used the browsing strategy heavily, progressing on a non-linear search for relevant sites. Students rarely used the analytical search. When they did, it was usually in the selection of new terms to use in a search. The empirical strategy was frequently used, since the students learned from other students' experience and their own successful searches, starting points etc. and re-applied these to new assignments. The known site strategy was also used frequently. The students wished they could use the similarity strategy but they didn't know how to execute it, or there were no technical functionality that enabled them to do so. The browsing and the empirical strategies were the most utilised and this is explained by the fact that the students were novices both in the domain they searched information about and Web searching. Both strategies can be executed with little or average knowledge about the

domain and system plus they require little mental effort. The students shifted among strategies when they encountered a problem applying the current strategy. Most searches started with empirical strategy and shifted to browsing (Pejtersen & Fidel, 1998).

5.3.5 Description of the search strategies.

The strategies that searchers use to plan the search and their criteria for choice among the different strategies in an information environment were originally studied in 134 examples from a set of user-intermediary negotiations collected in 1976 in Danish public libraries under everyday library conditions. The study involved the analysis of strategies employed by end-users and intermediaries. The aim of the investigation was to reveal the various tasks and search strategies, which the user/intermediary encounters in everyday work in public libraries (Pejtersen, 1988). The different search strategies represent different ways in which users and intermediaries categorise information during information retrieval in libraries. The strategies are implemented in the Book House with the exception of the empirical search strategy. The users weren't able to distinguish between the analytical and the bibliographical strategy, for which reason the latter was merged with the analytical strategy (Rasmussen, Pejtersen & Goodstein, 1994).

Analytical search strategy.

The analytical search strategy is a rational problem solving approach where the dimensions of the user's needs can be explored systematically, and need aspects can be compared with document aspects, and titles are suggested for the user's consideration (Pejtersen, 1990)**.** This strategy is employed when explicitly formulated information about the user's need is available for comparison with the book stock. Since the analytical search is based on an analysis of the user's expressed needs and a match between document attributes and formulations of user needs, it is a search in a network of relations between document attributes and parameters of user needs. This strategy is the rational way to reach a match between the user's need and document contents, but the strategy is rarely used in spite of the potentially high precision rate. The explanation for this may be found in the use of mental resources in relation to the strategy. Considering the demands on mental resources, the complexity of the information-processing task is important. The amount of information to be treated varies with each strategy, but is highest in the analytical strategy. The demands on short-term memory and long-term memory are higher within the analytical strategy than within other strategies, and there is a greater need for depth of knowledge about document contents and subject fields. The time needed for the analysis of the user' s world, the probing of the need, etc., is high in the analytical search strategy. When going through a list of demands in relation to the various strategies, the analytical strategy seems to put the heaviest demands on the searcher's mental resources. The analytical search method demands a complicated treatment of data because the intermediary in communicating with the user or the user himself must search simultaneously at four different levels: analysis of user's need; translation of needs into book contents; identification of a relevant selection of authors/titles; and physical search for them. The success of the application of the analytical strategy depends on a thorough knowledge of the contents of the book stock systematised according to users' criteria of value as well as an adequate interview technique or perception of the information need. The lack of an on-line retrieval system with representations of document contents as a support to the intermediary's memory, which can simplify the treatment of complex data, appears to be an important reason for the infrequent use of this strategy (Pejtersen, 1988).

The empirical search strategy.
This strategy is based upon the intermediary's purely empirical classification of users into typical categories, which are associated with a repertoire of typical sets of genres and book titles, the contents of which the intermediary usually doesn't know in depth. The user can express his/her need in many different ways—in library terms as well as in terms of needs—but the statements are not conceived as a starting point for an analysis of the need. Together with other features in the situation such as gender, age, language, etc. they are perceived as signals which characterise the user in relation to the intermediary's typical categories. The negotiations demonstrate an evident correlation between gender, age and specific authors/titles. For example, middle-aged women are repeatedly offered the same set of authors. The intermediary "recognises" the user's need by a combination of gender, age, question formulation and probably other features in the actual situation. The intermediary recognises the need and uses the books on the shelf to support his/her memory of title/author associations. There are indications from the way the intermediary uses and comments on the individual books that the stereotypical set of titles are classified unconsciously in a manner which is not exclusive but in accordance with various "user signals". Consequently, the intermediary's questions to the user, when searching empirically call for confirmation of signals on the basis of which the intermediary's book sets are classified in order to check that s/he operates within the right set. Years of experience with different user signals and acceptance of specific authors/titles may supply the intermediary with the empirical foundation. To judge from the user's reactions to book proposals, the empirical strategy often seems to represent a sufficient search. Problems arise when the intermediary's set of titles is too limited, either because the user already knows the books or because the stereotyped set does not correspond with the individual user's actual need, even though the user situation has common features with the intermediary's typical criteria of categorising. The most common reaction to problems of this kind is associative leaps to other categories of books or simply free associations, the origin of which cannot be traced in the conversations. It seems significant that the intermediary may substitute an analytical search for the intuitive empirical search method when an unusual situation occurs (Pejtersen, 1988).

The browsing strategy.
The intuitive browsing strategy is characterised by a lack of requirements to document as well as information specificity. The search can be part of a process of need recognition, of search question formulation and of a learning process, where the strategy is a means to get new knowledge or new associations and ideas within a familiar or a new subject domain. The need is usually vaguely defined and, when browsing, the user and intermediary intuitively explore the stocks for good ideas (Pejtersen, 1988). There is no explicit mental model of the user's domain and intentions activated during browsing. This search strategy primarily works in the user's and intermediary's tacit knowledge of the library and user domain and looks for a match with users' previous experiences. In such situations, many intuitive judgements are to be expected together with the use of number of simple rules that reduce a complex evaluation problem to more simple judgements. All kinds of pragmatic values, associations, and experiences are involved to recognise relevant documents. Such a strategy is appropriate in unfamiliar domains when no explicit characterisation of the specific information to be retrieved is available. However, it is also useful within familiar knowledge domains in situations when the need is implicit or not known or simply vaguely defined. Sometimes the browsing strategy is chosen because factors other than a quick solution have a high priority. Such values include enjoying the

scanning process itself because of new associations and ideas, improved comprehension, and learning of the concepts of a domain and its variety of information features.
The browsing approach can be a separate strategy but it is also likely to occur as a sequence before and during other search strategies. Since this strategy usually demands few mental resources and meets few constraints, a switch to browsing will often take place in any kind of search as a means for associative exploration, formulation, and even revision of anticipated needs.
The success of the browsing strategy depends on the availability of aids that meet twofold demands. One is a very information rich environment with a great variety of information sources with different types of representations of information that support associations and cueing to users' context. The other is concerned with the need for some kind of an organisation of information matching users' knowledge domain into operational subsets for browsing (Rasmussen, Pejtersen & Goodstein, 1994).

Search by analogy
In the associative search by analogy strategy a specific book mentioned by the user is the basis for the retrieval of new documents with features identical to those of the model document. This search is therefore a search in a network of relations between attributes of documents in order to achieve a match between the features of documents in the information system and the features of the named book, or it is a search for documents with a specified, selective number of features in common with the named book. In both cases, the search by analogy is a version of the analytical search strategy. The named book can be the focus for the analysis of users' needs, checking document features along different dimensions in order to identify which of the features are representative of the user's need. Search by analogy is often combined with the empirical strategy. From this it follows that the intermediary associates the named book with a stereotypical category of documents, and other items belonging to this same category are retrieved. In the analytical search by analogy the information flow is the probing of attributes of the named document in order to determine the selectivity of the need. In the empirical search by analogy the information flow is identical with that of the empirical strategy, where the user's acceptance/rejection of the intermediary's suggestions of authors/titles proves or disproves the intermediary's association of the named book with a similar category of books (Pejtersen, 1988).

The bibliographical search strategy.
In this strategy, the user probes the book stock and selects books himself/herself typically asking for assistance from the librarian with questions which refer to author/title. In the bibliographical search both user and intermediary communicate in library terms and they are occupied with the user's need in terms of authors/titles and their location in the library. The intermediary is the passive helper, assisting in the user's physical search in the library or verifying his/her incomplete references and instructing in library conditions and management. The closing act is either the finding of the wanted book or the intermediary's proposal for a book reservation. It is thus characteristic that the intermediary rarely changes to another strategy; s/he is first and foremost defining the task as the manipulation of tools within the framework of the library system. The bibliographical search strategy was the most frequent, and occurred 125 times in total. It is the most monotonous and least complicated of all search methods identified in the study. This may possibly explain the intermediary's low interest in shifting to other strategies, even when the user seems to set the stage for it. This strategy is a highly skilled routine task, where the user's and the intermediary's mutual understanding of the task is straightforward. The existing retrieval

tools match the strategy to a large extent, and hence the information flow between user and intermediary usually focuses on the cognitive task of comparing the user's, often inadequate, model of the library domain with the actual conditions in the domain (Pejtersen, 1988).

5.3.6 Discussion.

The Book House supports the frequent shifts among search strategies, which were observed in the empirical studies. The system gives the user free access to shift between the different strategies independent of the current stage of the search. This gives the user the option of having different responses from the database to search questions in terms of new search sets with different content according to the strategy applied. This will help the user to explore the content of the database and to revise his information need accordingly.
The analysis of information processing strategies showed a great difference in the mental resources required by different search strategies and in the precision of search. Mental workload is an influential criterion for the user's choice of strategy and therefore it is important, when possible, to let the computer take over those search processes that are particularly resource demanding. The analyses showed that the analytical strategy is particularly resource demanding. At the same time, this strategy is very effective with respect to precision and, therefore special attention is needed to provide a support that is adequate to make the strategy preferable to the user during search. In the Book House system an attempt is made to make each strategy require an equal amount of user expertise by matching the interface displays to the user's capabilities. There is also a role allocation between the computer and the user, which ensures that the computer handles the planning of formal combinations of search terms, i.e. the Boolean logic, and leaves the user resources to focus on need situation analysis, exploration and subsequent evaluation of the retrieved documents.
Several, alternative computer functions and retrieval algorithms are needed to serve the user's operation on the database and the transformation of queries into resulting sets of retrieved documents. Retrieval functions must introduce a proper relationship between the organisation of the database and the users' different formulation of needs as expressed in their choice of search strategy. Each strategy will require its own set of retrieval functionality and heuristics (Rasmussen, Pejtersen & Goldstein, 1994).

6 References

Analyseinstituttet MindResearch. Psykologiske teknikker ved fokusgruppeinterview. [citeret 20. dec. 2000]. Tilgængelig på Internet: http://www.mindresearch.dk/forside.html>.
Mehlbye, Jill ; Rieper, Olaf ; Togeby, Mikael – Håndbog i evaluering. København: AKF Forlaget, 1993. 180 p.
Nielsen, Jacob – Usability engineering. Boston: AP Professional, 1993. Xiv, 362 p.
Pejtersen, Annelise Mark – The mediator's role as a mediator in fictive literature. In: The Fourth International Research Forum in Information Science / edited by I. Friberg. Borås, 1981. p. 178-207.
Figure 7:
a: Actor from Danish TV series
b: Actor from Danish TV series
c: Virtual Friend: http://www.virtualfriend.com/default2.asp (cited 30 Nov. 2000. The site has changed since the experiment and is currently under construction)
d: Nicole: http://nicole-sf1.nativeminds.com/default.htm (cited 30 Nov. 2000)
e: Lego: http://shop.lego.com/gateway.asp (cited 30 Nov. 2000)

f: Quest: http://www.shadowboxer.com/quest (cited 30 Nov. 2000)
g: Tokiama: http://www.vperson.com/sapphire2000/index.htm (cited 30 Nov. 2000)
h: E-cyas: http://www.e-cyas.com/index_eng.php3 (cited 30 Nov. 2000)
i: Eve: http://www.egain.com/egainassistant.htm (cited 30 Nov. 2000)
j: Cogito: (Private communication)

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Evaluation of Agents and Study of End-user needs and behaviour for E-commerce

COGITO Focus group experiment

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Abstract (Max. 2000 char.)
The process of buying products and services on the Internet often implies a high degree of complexity and uncertainty about the conditions of information seeking, about items for sale, the purchase of wanted products and the actual navigation on a site. Some important problems concerning e-commerce in general and shopping at Internet bookstores in particular are outlined below.
In this report user requirements for specification of web-sites meeting the overall wishes of the end-users have been elicited. The needs are mainly based on experiments and discussions related to purchase of books, as this domain has been selected as the application domain for the e-commerce in COGITO, but the requirements are mostly common covering e-commerce in general.
One of the main features to consider, analyse and specify in COGITO was the use of 'intelligent personalised agents'. Therefore, a focus group experiment was set up to investigate and specify needs especially for this aspect. The focus group experiment was extended as compared to normal focus group discussions by having both individual 'interview by doing' sessions and group discussions. Based on a thorough analysis of the outcome of these sessions a list of end-user requirements was assembled and presented in a hierarchical structure presenting the strategic requirements as well as the procedures and operations supporting these requirements. Furthermore, in this experiment the associations of the members of the focus group concerning various types of agents were tried out in order to point to some main conclusions related to the choice of agent type.
Furthermore, as a specific and very important aspect an overview of search strategies has been presented and related to a general cognitive systems engineering method for information seeking and retrieval in a variety of domains.
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Descriptors
Intelligent agents, e-commerce, focus group investigation

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